# ME603 - Operations Research

P. Pages : 3

Time : Three Hours

|| *1348* ||

Max. Marks : 80

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Notes :  1.  All questions carry marks as indicated.
  2.  Answer Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8, Q. 9 or Q. 10
  3.  Illustrate your answers wherever necessary with the help of neat sketches.
  4.  Use of non programmable calculator permitted.
  5.  Use of Random No-chart and Normal std. distribution table is permitted.

**1.**  a)  i)  Discuss various phases of operation research and its importance.  **8**

  ii)  What is the role of operations research in decision making ?  **8**

**OR**

**2.**  a)  Solve the following LPP by simplex method.  **12**
  Minimize $Z = 5x_1 + 3x_2$

  subject to

$$2x_1 + 4x_2 \leq 12$$
$$2x_1 + 2x_2 \leq 10$$
$$5x_1 + 2x_2 \geq 10$$
$$x_1, x_2 \geq 0$$

  b)  Verify the results of above LPP by graphical method.  **4**

**3.**  A company has 5 jobs to be done the following matrix shows the return in RS. Assign the five jobs to five machines so as to maximize the total expected profit.  **16**

| Job M/C | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| A | 5 | 11 | 10 | 12 | 4 |
| B | 2 | 4 | 6 | 3 | 5 |
| C | 3 | 12 | 5 | 14 | 6 |
| D | 6 | 14 | 4 | 11 | 7 |
| E | 5 | 9 | 8 | 12 | 5 |

**OR**

**4.**  Determine optimal solution to the problem given in Table 4.1. Obtain initial solution by VAM.  **16**

Table 4.1

| From \ To | | MARKET | | | | Supply |
|---|---|---|---|---|---|---|
| | | $M_1$ | $M_2$ | $M_3$ | $M_4$ | |
| P L A N T | $P_1$ | 6 | 4 | 9 | 1 | 40 |
| | $P_2$ | 20 | 6 | 11 | 3 | 40 |
| | $P_3$ | 7 | 1 | 0 | 14 | 50 |
| | $P_4$ | 7 | 1 | 12 | 6 | 90 |
| Demand | | 90 | 30 | 50 | 30 | |

**5.** A small project consist of seven activities, the details are given below. **16**

| Activity | Depends on | Time Estimates | | |
|---|---|---|---|---|
| | | $t_o$ | $t_m$ | $t_p$ |
| A | - | 1 | 3 | 7 |
| B | A | 2 | 6 | 14 |
| C | A | 3 | 3 | 3 |
| D | B, C | 4 | 10 | 22 |
| E | B | 3 | 7 | 15 |
| F | D, E | 2 | 5 | 14 |
| G | D | 4 | 4 | 4 |

i) Find critical path

ii) Find the probability that project is completed within 31 days

iii) Find the probability that project is completed 2 days earlier that project duration.

iv) What project duration will have 55% confidence of completion ?

**OR**

**6.** A marketing manager wants to launch a new product. The activity breakdown, normal and crash durations and costs are given in table 6.1 **16**

Table 6.1

| Activity | Dependency | Normal | | Crash | |
|---|---|---|---|---|---|
| | | Duration | Cost | Duration | Cost |
| A | - | 3 | 50 | 2 | 100 |
| B | - | 2 | 75 | 1 | 150 |
| C | - | 6 | 140 | 4 | 260 |
| D | A | 5 | 100 | 3 | 180 |
| E | A | 7 | 115 | 6 | 145 |
| F | B | 2 | 80 | 2 | 80 |
| G | C, D, F | 4 | 100 | 2 | 240 |

If the indirect cost is Rs. 60/- per day, find the optimal project duration. Also find minimum duration and its cost.

**7.** A computer contain 10000 resistors, the cost of replacing a register individually is Rs. 5/- only. The cost of replacing a register in group is Rs. 2/- per register. **16**
The % of registers surving at the end of n months is given below.

| Month | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| % of surving at the end of the month | 100 | 97 | 90 | 70 | 30 | 15 | 0 |

i) What is the optimum replacement plan.

ii) What should be the cost of resistor so that we prefer individual replacement policy over group replacement policy.

**OR**

**8.** a) Explain the following :

i) ABC Analysis. **6**

ii) VED Analysis. **2**

b) A company requires 16000 units of raw material costing Rs. 2 per unit. The cost of placing an order is Rs. 45/- and the carrying costs are 10% per year per unit of the average inventory. Determine : **8**
   i) Economical order quantity.
   ii) Cycle time.
   iii) Total variable cost of managing the inventory.

**9.** a) A self service store employs one cashier at its counter 8 customers arrive on an average every 5 minutes while the cashier can serve 10 customers in the same time. Assuming Poisson's distribution for corrival and exponential distribution for service rate, Determine : **8**
   i) Average no of customers in the system.
   ii) Average no. of customers in the Queue.
   iii) Average time customer spends in the system.
   iv) Probability that there are more than 2 customers in the system.

b) Discuss characteristics of Queuing model. **8**

### OR

**10.** Arrivals at a public telephone booth are considered to be Poisson with an average time of 5 minutes between an arrival and the next. The length of a phone call can be assumed to be distributed exponentially with a mean of 3 minutes. Use Monte Carlo simulation technique to find out : **16**
   i) Average waiting time for customer.
   ii) Probability that a customer has to wait.

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